IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT:	Zhuang et al.	EXAMINER:	Hom, Shick C
SERIAL NO.:	10/813,476	GROUP:	2666
FILED:	03/30/2004	CASE NO.:	CML01499M
ENTITLED:	METHOD AND APPARATUS FOR PILOT SIGNAL TRANSMISSION		

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AMENDMENT

Honorable Commissioner of
  Patents and Trademarks
Alexandria, VA 22313-1450

Sir:

In view of the issues raised in the office action mailed December 28, 2005 and the Advisory Action mailed May 17, 2006, the following amendment and response is hereby respectfully submitted by the applicants. Entry of the amendments herein, reconsideration of any outstanding objections and/or rejections and allowance of the present application are respectfully requested.

CLAIM LISTING

1. (original)   A method for assigning a pilot sequence to communication units within a communication system, the method comprising the steps of:

assigning a first communication unit a first pilot sequence, wherein the first pilot sequence is selected from a group of pilot sequences constructed from a set of Generalized Chirp-Like (GCL) sequences; and

assigning a second communication unit a second pilot sequence taken from the group of pilot sequences constructed from the set of GCL sequences.

2. (original)   The method of claim 1 wherein the step of assigning the first communication unit the first pilot sequence comprises the step of assigning a first base unit the first pilot sequence, and wherein the step of assigning the second communication unit the second pilot sequence comprises the step of assigning a second base unit the second pilot sequence.

3. (original)   The method of claim 1 wherein the step of assigning the first communication unit the first pilot sequence comprises the step of assigning a first remote unit the first pilot sequence, and wherein the step of assigning the second communication unit the second pilot sequence comprises the step of assigning a second remote unit the second pilot sequence.

4. (original)   The method of claim 1 wherein the step of assigning the first communication unit the first pilot sequence comprises the step of assigning a first sector of a base station the first pilot sequence, and wherein the step of assigning the second communication unit the second pilot sequence comprises the step of assigning a second sector of the base station the second pilot sequence.

5. (original)   The method of claim 1 wherein the step of assigning the first communication unit the first pilot sequence comprises the step of assigning a first antenna of a sector of the base station the first pilot sequence, and wherein the step of assigning the second communication unit the second pilot sequence comprises the step of assigning a second antenna of a sector of the base station the second pilot sequence.

6. (original)   The method of claim 1 wherein prior to assigning the first and the second communication units the first and the second pilot sequences, performing the step of determining

a length of the pilot sequences (N_G) based on a number of pilot sequences needed in the communication system (K) and a desired pilot sequence length (N_p).

7. (original)   The method of claim 6 further comprising the step of:
        choosing N_G to be equal to N_p if the smallest prime factor of N_p excluding "1" is larger than K.

8. (original)   The method of claim 6 further comprising the step of:
        choosing N_G to be a smallest integer that is greater than N_p and whose minimum prime factor excluding "1" is larger than K and generating the set of GCL sequences by truncating sequences in the set to N_p; or
        choosing N_G to be a largest integer that is smaller than N_p and whose minimum prime factor excluding "1" is larger than K, and generating the set of GCL sequences set by repeating beginning elements of each sequence in the set to append at an end of each sequence to reach the desired length N_p.

9. (original)   The method of claim 1 wherein the first and the second pilot sequences are constructed from the GCL sequences or from sequences resulting from taking a size- N_G unitary transformation of the GCL sequences; and the GCL sequences are generated as

$$S_u = (a_u(0)b, a_u(1)b, \ldots , a_u(N_G\text{-}1)b),$$

where b is any complex scalar of unit amplitude and

$$a_u(k) = \exp(-j2\pi u \frac{k(k+1)/2 + qk}{N_G}),$$

where,

$u = 1, \ldots N_G\text{-}1$ is known as the "class" of the GCL sequence
$k = 0, 1, \ldots N_G\text{-}1$
$q = any\ integer.$

10. (currently amended)   The method of claim 9 wherein the step of assigning the first communication unit the first pilot sequence comprises the step of assigning the first communication unit a pilot sequence constructed from the class-u_1 GCL sequence; and

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wherein the step ~~the~~ <u>of</u> assigning the second communication unit the second pilot sequence comprises the step of assigning the second communication unit a pilot sequence constructed from the class-u_2 GCL sequence that satisfies the requirement of $|u_1-u_2|$ being relatively prime to N_G.

11. (currently amended)   A method comprising the steps of:

receiving a pilot sequence as part of an over-the air transmission, wherein the pilot sequence is constructed from a set of Generalized Chirp-Like (GCL) sequences <u>and is uniquely assigned to either a base unit or a remote unit</u>; and

utilizing the pilot sequence for at least one of the following:

acquisition and tracking of timing and frequency synchronization, estimation and tracking of desired channels for subsequent demodulation and decoding, estimation and monitoring of characteristics of other channels for handoff purposes, and interference suppression.

12. (original) The method of claim 11 wherein the step of receiving the pilot sequence comprises the step of receiving the pilot sequence at a base unit.

13. (original) The method of claim 11 wherein the step of receiving the pilot sequence comprises the step of receiving the pilot sequence at a remote unit.

14. (original) The method of claim 11 wherein the step of receiving the pilot sequence comprises the step of receiving a pilot sequences constructed from GCL sequences or from sequences resulting from taking a size-N_G unitary transformation of the GCL sequences, and the GCL sequences are generated as

$$S_u = (a_u(0)b,\ a_u(1)b,\ \ldots,\ a_u(N_G\text{-}1)b),$$

where b is any complex scalar of unit amplitude and

$$a_u(k) = \exp(-j2\pi u \frac{k(k+1)/2 + qk}{N_G}),$$

where,

$u=1, \ldots N_G\text{-}1$ is known as the "class" of the GCL sequence

k=0, 1, . . . N_G-1
q=any integer.

15. (currently amended)   A communication unit comprising:
    pilot channel circuitry for transmitting or receiving a pilot channel sequence, wherein the pilot channel sequence comprises a sequence ~~unique~~ <u>uniquely assigned</u> to the communication unit and is constructed from a GCL sequence.

16. (original)   The communication unit of claim 15 wherein the GCL sequence is equal to

$$S_u = (a_u(0)b, a_u(1)b, \ldots, a_u(N_G-1)b),$$

where *b* is a complex scalar of unit amplitude and

$$a_u(k) = \exp(-j2\pi u \frac{k(k+1)/2 + qk}{N_G}),$$

where,

u=1, . . . N_G-1 is the "class" of the GCL sequence
k=0, 1, . . . N_G-1
q=any integer.

17. (original)   The communication unit of claim 15 further comprising:
    data channel circuitry for transmitting data, wherein a peak to average power ratio (PAPR) of the pilot channel sequence is lower than a PAPR of data transmitted over the data channel circuitry.

18. (original)   The communication unit of claim 17 wherein the pilot channel sequence is transmitted at a higher power than the data.

REMARKS

Claims 6-10, 14 and 16-18 are regarded as allowable if properly rewritten. Claims 11-13 and 15 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Roman (U.S. Publication Number 2003/0152136), claims 1-4 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Roman in view of Matsumoto (U.S. Patent Number 6,704,552), and claim 5 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Roman and Matsumoto in view of Popovic (U.S. Patent Number 6,804,307). Respectfully disagreeing with these rejections, reconsideration is requested by the applicants. Nonetheless, claims 10, 11 and 15 have been amended to more clearly describe what is claimed and to further highlight the distinctions between what is claimed and what the cited art teaches.

Regarding the rejection of claims 1-5, the Examiner asserts that "Roman discloses all the subject matter of the claimed invention with the exception of a first and second communication unit being assigned a first and second pilot sequence, respectively." Page 6, section 6 of the present office action. To fill this void, the Examiner cites Matsumoto col. 4 lines 4-22 and asserts that "it is known to provide wherein a first and second communication unit being assigned a first and second pilot sequence respectively." Page 7, section 6 of the present office action. Matsumoto col. 4 lines 4-22 reads as follows (emphasis added):

> In order to still further achieve the above objects, a receiver according to an embodiment of the present invention comprises a radio communication unit having an oscillator, that receives a signal and outputs a received signal, a plurality of first despreaders that despread the received signal with a first spread code **to output first pilot signals of a first channel which has been spread with the first spread code**, a second despreader that despreads the received signal with a second spread code **to output a second pilot signal of a second channel which has been spread with the second spread code**, and an automatic frequency controller that calculates a difference between an oscillating frequency of the oscillator and a frequency of the received signal for each of the first and second channels based on the first pilot signals and the second pilot signal to supply a frequency control signal to the oscillator, whereby the oscillating frequency of the oscillator is controlled so that the oscillating frequency is substantially equal to the frequency of the received signal.

In contrast, independent claim 1 recites (emphasis added) "assigning a first communication unit a first pilot sequence, wherein **the first pilot sequence is selected from a group of** pilot sequences <u>constructed from</u> a set of Generalized Chirp-Like **(GCL) sequences**; and assigning a second communication unit **a second pilot sequence** <u>taken from the group of</u> pilot sequences <u>constructed from</u> the set of **GCL sequences**." As cited by the Examiner above, Matsumoto teaches transmitting two different pilot signals via two different **channels** using two different **spreading codes**. The applicants submit that this neither teaches nor suggests assigning a first and a second **communication unit** a first and a second pilot sequence, where each pilot sequence is taken from **a group of pilot sequences** that are **constructed from a set of GCL sequences**. Instead, Matsumoto teaches the use of spreading codes on different channels.

Regarding a group of pilot sequences being constructed from a set of GCL sequences, the Examiner relies on Roman [0041-0042 and 0053], which reads as follows (emphasis added):

> [0041] To solve the LO frequency drift problem, especially in situations where the transmitting LO is not particularly stable, the receiver uses **a two-chirp differential calculation** to resolve the frequency drift uncertainty. This is accomplished by configuring the transmitter to send a combination of conventional **up-chirping pulses** and **down-chirping pulses**.

> [0042] Each chirp produces a pulse at the output of the receiver's matched filter, separated in time by T o+D, where To is the known spacing between the **up-chirp and down-chirp signal**, and delta-f is proportional to D. Thus, **using the two types of chirp waveforms as a "pilot signal,"** the receiver can determine delta-f directly and thus synchronize the local LO to the transmitter LO, using conventional tuning devices or processes. Once synchronized, the receiving device can use the delta-f information to properly modulate its own data transmissions, allowing rapid sync at the other end....

> [0053] The detector 400 is composed of two matched filters. The internal one (close to the RF/analog) is matched to Code 1, and may be of a QPSK direct sequence type as (in the general sense) the direct sequence phase can take any of the values of 0, 90, 180, or 270 degrees. The Code 2 filter 410 **performs the chirp-like or polyphase matched filtering over the whole sequence length** of (N·M)/R seconds. Both matched filters run at the sampled rate of R, but Code 2 has an equivalent chip rate of R/N, therefore the taps from the shift register come every N positions.

However, the applicants submit that Roman, as cited by the Examiner above, also does not teach or suggest the use of **a group of pilot sequences** that are **constructed from a set of GCL sequences**. Moreover, the applicants submit that Roman, as cited by the Examiner above, does not teach or suggest **assigning** even one communication unit a pilot sequence selected from a group of pilot sequences constructed from a set of GCL sequences.

Rather, the applicants respectfully submit that the Examiner is relying on considerable hindsight in combining and interpreting Roman and Matsumoto, as cited above, in rejecting claim 1. The Examiner appears to be asserting that the phrase in Roman, which reads "using the two types of chirp waveforms as a 'pilot signal,'" suggests a lot. Thus, the applicants do not see where Roman describes the use of GCL sequences, particularly for constructing a group of pilot sequences, and request that the Examiner explain in greater detail how Roman is asserted to teach or suggest constructing a group of pilot sequences from a set of GCL sequences. The applicants note that Popovic appears to provide some background information regarding GCL sequences **generally**, beginning at Popovic column 5, line 28 and continuing for a number of paragraphs. The applicants contrast this discussion in Popovic, regarding GCL sequences, to the cited portions of Roman. The applicants further note that Popovic is not cited in the rejection of claim 1, nor do the applicants see a motivation for combining Popovic with Roman and Matsumoto.

Regarding the rejection of claim 15, the Examiner relies on Roman [0041-0042 and 0053], quoted above. Claim 15 recites (emphasis added), "A communication unit comprising: pilot channel circuitry for transmitting or receiving a pilot channel sequence, wherein the pilot channel sequence comprises a sequence **unique to the communication unit** and is **constructed from a GCL sequence**." First, the applicants do not see where Roman describes the use of GCL sequences, particularly for constructing a group of pilot sequences, and request that the Examiner explain in greater detail how Roman is asserted to teach or suggest constructing a group of pilot sequences from a set of GCL sequences. The applicants note that Popovic appears to provide some background information regarding GCL sequences **generally**, beginning

at Popovic column 5, line 28 and continuing for a number of paragraphs. The applicants contrast this discussion in Popovic, regarding GCL sequences, to the cited portions of Roman. The applicants further note that Popovic is not cited in the rejection of claim 15, nor do the applicants see a motivation for combining Popovic with Roman.

Second, the pilot channel sequence of claim 15 comprises a sequence **uniquely assigned to the communication unit**. The applicants note that regarding the rejection of claims 1-5, the Examiner asserts that "Roman discloses all the subject matter of the claimed invention with the exception of a first and second communication unit being assigned a first and second pilot sequence, respectively." Page 6, section 6 of the present office action. In the Advisory Action, the Examiner cites Roman [0013] as teaching the "detection of identification signals." Roman [0013] says, "What is needed is a communications system that enables fast acquisition and coherent detection of low data rate identification signals without the cost and complexity of typical coherent receivers." The applicants submit that this one sentence reference neither teaches nor suggests a pilot channel sequence comprising a sequence uniquely assigned to the communication unit and that is constructed from a GCL sequence.

Regarding the rejection of claim 11, the Examiner relies on Roman [0041-0042 and 0053], quoted above. Claim 11 recites (emphasis added), "receiving a pilot sequence as part of an over-the air transmission, wherein **the pilot sequence is constructed from a set of Generalized Chirp-Like (GCL) sequences** and is **uniquely assigned** to either a base unit or a remote unit." First, the applicants do not see where Roman describes the use of GCL sequences, particularly for constructing a group of pilot sequences, and request that the Examiner explain in greater detail how Roman is asserted to teach or suggest constructing a group of pilot sequences from a set of GCL sequences. The applicants note that Popovic appears to provide some background information regarding GCL sequences **generally**, beginning at Popovic column 5, line 28 and continuing for a number of paragraphs. The applicants contrast this discussion in Popovic, regarding GCL sequences, to the cited portions of Roman. The applicants further note that Popovic is not cited in the rejection of claim 11, nor do the applicants see a motivation for combining Popovic with Roman.

Second, the pilot sequence of claim 11 comprises a sequence that is **uniquely**

assigned to either a base unit or a remote unit. The applicants note that regarding the rejection of claims 1-5, the Examiner asserts that "Roman discloses all the subject matter of the claimed invention with the exception of a first and second communication unit being assigned a first and second pilot sequence, respectively." Page 6, section 6 of the present office action. In the Advisory Action, the Examiner cites Roman [0013] as teaching the "detection of identification signals." Roman [0013] says, "What is needed is a communications system that enables fast acquisition and coherent detection of low data rate identification signals without the cost and complexity of typical coherent receivers." The applicants submit that this one sentence reference neither teaches nor suggests a pilot sequence constructed from a set of Generalized Chirp-Like (GCL) sequences and that is uniquely assigned to either a base unit or a remote unit.

Since none of the references cited, either independently or in combination, teach all of the limitations of independent claims 1, 11 or 15, or therefore, all the limitations of their respective dependent claims, it is asserted that neither anticipation nor a prima facie case for obviousness has been shown. No remaining grounds for rejection or objection being given, the claims in their present form are asserted to be patentable over the prior art of record and in condition for allowance. Therefore, allowance and issuance of this case is earnestly solicited.

The Examiner is invited to contact the undersigned, if such communication would advance the prosecution of the present application. Lastly, please charge any additional fees (including extension of time fees) or credit overpayment to Deposit Account No. **502117 -- Motorola, Inc.**

Respectfully submitted,
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